CYSTS OF THE SUPRARENAL GLAND.

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THE classification of tumors of the suprarenal glands is far from perfect. Numerous isolated cases of different varieties of tumors have been reported, but until within recent years their classification has been very unsatisfactory. We know that tubercular processes of one or both of these organs are not uncommon. Probably about 80 per cent. of the lesions of the adrenal body are of this character. A few successful operations for removal of a unilateral tubercular adrenal have been reported.

It is not my intention in this article to discuss the various types of tumors or that interesting class of cases, the aberrant adrenals. I will but briefly mention the different growths which have been described as developing in these bodies.

Malignant Tumors.—Numerous cases have been reported. The classification of several of these tumors has, however, been very indefinite, and it has been uncertain whether the term carcinoma, sarcoma, endothelioma or adenoma should be applied. It can, I think, be positively stated that primary carcinoma is very rare, primary sarcoma perhaps slightly less rare. Ramsay[1] has collected 37 cases of primary carcinoma and 30 cases of primary sarcoma of the adrenal bodies. On the other hand, secondary involvement with either of these malignant growths is quite common.

Adenoma.—A number of cases have been reported where a tumor or tumors of this character have been found at autopsy, and a few doubtful cases have been found at operation. Such tumors occur either as numerous small nodules situated in the cortex, or as masses of considerable size which develop in the substance of the gland. The appearance of these growths does not differ much from that of the normal cortex. Occasionally,

as the result of degeneration, small cysts are found in these tumors. Virchow used the term *struma lipomatosa suprarenalis* to certain growths, probably adenomata, which had undergone fatty degeneration.

FIBROMA. GLIOMA. ANGIOMA. LYMPHANGIOMA.

Cysts.—The classification of adrenal cysts rests upon rather an indefinite basis. Those of a malignant, parasitic or tubercular character should be easily recognized, though it is true that in the past there has been considerable confusion in the nomenclature of even the malignant types. There remain, however, certain cysts which can not be classed under either of these three divisions. True cystomata are unquestionably very rare. Sick [2] reports a case of ciliated epithelial cyst found at the autopsy of a female who succumbed after a hysterectomy for uterine cancer. In his discussion of the case, he enters fully into the nature and origin of adrenal cysts. There still remains, however, a considerable number of cysts which will not properly arrange themselves under any one of these divisions. There has been considerable discussion in regard to their origin and true character. Such terms as angiomatous, lymphangiomatous, lymphangiectatic, lymphatic, follicular, strumous, degenerative, retention, infarction, etc., have been applied, and it is very difficult to classify many of the cases under any special head. Some are undoubtedly due to the cystic degeneration of angiomatous or lymphatic tumors, others to the degenerative process resembling that which occurs in the aberrant adrenals of the kidney. Klebs considers them as analogous to the multiple retention cysts of the glandular organs, inasmuch as they arise from the glandular tubes of the adrenal cortex. Virchow [3] and others describe these cysts as analogous to those which as a result of a cystic follicular inflammation, develop in the thyroid gland, the so-called "suprarenal struma." Henschen,[4] in an elaborate article on this subject, is inclined to share this view, and claims that many adrenal cysts are similar to those which form in goitre, and he still clings to the old term "struma adrenalis." Drou-

blaix [5] and Fielder [6] also incline to the same belief, that many of these cysts take their origin from a parenchymatous degeneration of the gland, a form of acute inflammation. The hæmorrhagic origin of these cysts is emphasized by many writers. Apparently, in certain cases a hæmatoma has been the exciting cause of the cyst. By some writers this is considered the most common cause. A hæmorrhage, however, which has occurred in a cyst already existing, may so alter the characteristics of that cyst, that its original character is not recognizable. In this connection, hæmorrhage due to thrombosis of the adrenal vein, either its main trunk, or one of its chief branches, must be considered. Simmonds [7] collected 7 such cases, but these all occurred in patients with some form of chronic disease of the heart or lungs. It is a question whether such thromboses are not produced by some pre-existing disease of the adrenal body.

The relationship of hæmorrhage to adrenal cysts is certainly of interest. Adrenal hæmatoma in the newborn is not uncommon. We are at a loss, however, to explain the reason for such hæmorrhages. Can the compression of the infant's abdomen during its passage into the world be the cause? Is it possible that, at the moment of change from the fœtal circulation, there is some unknown activity of the adrenal gland? On this point we must confess ignorance. We know that in the fœtus the suprarenal body is proportionately large and very active. As to the frequency of hæmorrhages in the newborn, authorities differ. Thus, Mattei [8] found that in 100 autopsies, 75 of the cadavers showed some sign of hæmorrhage. Rolleston [9] in 130 autopsies found similar indications in 26. Adrenal hæmorrhage in the newborn is probably not uncommon, but in the great majority of cases there are no symptoms to indicate the occurrence of such a lesion, and the hæmatoma is quickly absorbed. It is equally difficult to understand why in adults these hæmorrhages should occur. The deep situation of the adrenal bodies would seem to be sufficient protection from injury, except that of the severest character, and yet in a certain proportion of these cases the cause has

apparently been a trauma. These organs are exceedingly vascular, and at times are subject to temporary passive engorgement. Another cause of hæmorrhage is unquestionably bacterial invasion, and several hæmorrhages of considerable size have been reported as due to this cause. The hæmorrhage may be also due to toxæmia from irritating chemical poisons. In animals who have been injected for experimental purposes with sera or antitoxins, as, for example, that of diphtheria, severe congestions and occasionally hæmorrhages have occurred. The hæmatoma are usually of small size, varying from that of a pea to a hen's egg. They are often laminated, the layers of different shades showing the repeated hæmorrhages, and the different stages of organization of the clot. Large hæmorrhages are rare. The hæmorrhage generally occurs, either in the deepest part of the cortex, or in the vascular zone between the medulla and the cortex. If the hæmorrhage is considerable in amount, the capsule may be ruptured. Arnaud [10] found that this accident had occurred in 6 out of the 79 cases of adrenal hæmatomata which he had been able to collect. In a few cases there has been very extensive blood extravasation and even rupture through the peritoneum into the abdominal cavity. Undoubtedly the majority of these hæmorrhages are absorbed and leave no trace.

In other cases, however, some structural change remains. If the hæmorrhage has been great, there may remain an encapsulated adrenal hæmatoma. In the encapsulating connective tissue, as well as in the semi-organized clot, there may be found chalky deposits and small cysts. Orth [11] says that a cystoid transformation may occur, fluid taking the place of the blood-clot. It is difficult to estimate the comparative frequency of these hæmatomata. The great number will probably give no symptom which would call attention to the suprarenal bodies. Mattei, in his examinations of 1301 cadavers, found that in 7 there were changes which indicated that at some previous time an adrenal hæmorrhage had occurred. Leconte [12] collected 52 cases of adrenal hæmorrhage in adults. Of these 33 were double, 8 right sided and 11 left sided.

Arnaud [13] reports 4 cases of very large adrenal hæmatomas. The causes were: 1. Burns. 2. Hydatid suppurating cyst of liver. 3. Abscess of the liver. 4. Cerebral apoplexy. In 69 cases collected by the same author, there were in 40 various pathological conditions of the adrenal bodies, which would account in part for the hæmorrhage.

Some of the causes which are assigned for adrenal hæmatoma are: Hæmorrhagic diathesis; co-existence of renal disease; chronic diseases of the circulatory and respiratory organs; septicæmic infections; acute toxic diseases, such as diphtheria, typhoid, osteomyelitis, etc.; tuberculosis; abscess of liver; burns; atheromatous arteries; cerebral lesions, apoplexy and meningitis; thrombosis of renal or adrenal vein.

The following brief reports of large adrenal hæmorrhage may be of interest.

CASE OF J. GREISELIUS (quoted by Rayer, *Journal d'Experience*, 1873). Male, æt. forty-five. Tumor in the left hypogastrium, which had ruptured intra-abdominally. Autopsy showed 12 pounds of blood in the peritoneal cavity.

CASE OF RAYER. Female, æt. seventy-five. For five years had suffered from crises of pain with vomiting and accompanied by bloody urine. Two months previous to death a cystic tumor was felt in the left hypogastric region. At autopsy 3 pounds of blood was found in the left adrenal body.

CASE OF CHIARI. Male, æt. sixty. (*Wien med. Presse*, 1880.) At autopsy a large mass of blood the size of an adult head, partly ancient, partly recent, was found in the right adrenal body.

Parasitic Cysts.—A few cases of echinococcus cysts, both uni- and multilocular, have been reported. For example, Huber [14] reported a small multilocular echinococcus cyst found at the autopsy of a man aged sixty-two. Perrin [15] reports a unilocular cyst of the right adrenal found at autopsy.

Numerous cases of adrenal cysts in animals have been reported, such as 2 cases of colloid cysts in the horse, reported by Bruckmüller and Kitt ("Lehrbuch Diagnostik Thierartze," 1895). 1 case of colloid cyst in a horse, reported by Manasse ("Virchow Archiv," vol. cxlv.) Several cases of epithelial cysts in birds reported by Kelly, Joubert and others.

Cases of cysts of large size have been reported by Rayer,[16]

Bossard,[19] Chiari,[16] Obendorfer,[17] Marchetti,[18] Krogius,[19] Schilling,[20] Lockwood.[21] The cases of Risdon-Bennet,[22] Klebs,[23] Morris [24] and Leconte [25] are of doubtful character.

As already stated, the pathological classification of these cysts is rather unsatisfactory. One of the best is perhaps that of Henschen:

1. Foreign body cysts (parasitical cysts).
   Echinococcus unilocularis et multilocularis.
2. True cysts (cystomata).
   a. Epithelial cysts.
      Follicular cysts.
      Ciliated epithelial cysts.
   b. Endothelial cysts.
      Lymphangiectasics.
      Lymphangiomata.
3. False cysts (cystoids).
   a. Tuberculous pseudocysts.
   b. Disintegration (softening) cysts.
   c. Hæmorrhagic cysts, originating by hæmorrhagic disintegration, or secondary metamorphosis of primary true cysts.

The following operations for removal of large adrenal cysts have been collected from the literature of the subject. The internal surfaces of the cyst walls have been quite characteristic, in all these cases small orange or yellowish-brown colored patches being dotted over the surface. These patches have varied in size from a minute speck to a plaque 1 cm. or more in diameter. The fluid has also been of a grayish-yellow or orange-brownish hue.

1. Case of Kronlein (rep. by Henschen).—Female, æt. forty-one. No history of trauma. During twenty years various diseases—pleurisy, epigastric pains occurring in attacks with vomiting, puerperal phlebitis, etc. In January, 1905, attack of rheumatism in several joints. A month later a swelling found in left loin, the diagnosis being, "hæmorrhagic cyst of the spleen which had ruptured into the left pleural cavity." Large cystic tumor under left costal arch. Puncture of cyst, 100 cm. of fluid extracted,

thin chocolate-colored, brownish in color, with cholesterin on surface and containing numerous fatty masses. Operation (laparotomy, February, 1905). Cyst extirpated, wall 3 to 8 mm. in thickness, its interior chocolate-colored, speckled with yellowish islands looking like sulphur or yellow butter. Followed by severe collapse. Death on fifth day, apparently from sepsis.

2. CASE OF ROUTIER (*Bull. Soc. Anat. de Paris*, 1895.)—Female, æt. thirty-six. No history of trauma. Ill for three years. Attacks of severe pain occurring in crises, rather intermittent. Operation (median laparotomy, December, 1894. Cyst contained 3 litres brownish fluid, could not be removed. Marsupialized. Death on third day due to peritonitis.

3. CASE OF PAWLICK (*Arch. klin. Chir.*, vol. liii. p. 582).—Female, æt. forty. Had been ill for five years. Large fluctuating tumor in left loin. Diagnosis uncertain as to pancreas, kidney or suprarenal body. Operation March 1, 1894. Through a canula 10 litres of bloody fluid ran out. Enucleation of greater part of the cyst wall, as far as the vertebral bodies; small portion left behind, cavity drained. Severe collapse followed the operation, with very slow convalescence. Two years later the patient was in good health.

4. CASE OF BIER (quoted by Henschen).—Female, æt. sixty-nine. Cystic tumor in right hypochondrium. Cyst contained 2 litres dark brown fluid, mixed with coagula, and could not be removed. Marsupialized. Death from shock at the end of a few days.

AUTHOR'S CASE.—A. H., female, æt. 45, married. Family history negative as to cancer or tuberculosis. Personal history good. Use of alcohol denied. Amputation of cervix uteri had been performed in October, 1905. About three years prior to admission to the hospital patient began to notice dull indefinite pain in the left loin and lower abdomen. The pain radiated downward towards the left hip and thigh. There were occasional sharp exacerbations of severe lancinating pain. The pain increased and soon became so severe that the patient resorted to the use of morphine, which she had employed in increasing doses for about two years. In less than a year after development of pain the patient noticed that the left side of her abdomen was becoming more prominent than the right, and soon afterwards she appreciated that a mass in her left hypochondriac region was steadily increasing in size, becoming more prominent and more tender. Her general health, up to the past six months had been good, but latterly she had begun to fail rapidly, and in the past few months had lost over 20 pounds in weight. She also noted that urination became more frequent, noted slight bronzing of the skin. *On examination* there was marked bulging in the left hypochondriac

region. A cystic tumor was felt bulging out the lower ribs, and extending well up under their free border, towards the vault of the diaphragm. The tumor was smooth and elastic to the touch, and gave a distinct sense of fluctuation very much as would a rather thick walled ovarian cyst. The tumor, however, was quite immovable, except that it moved up and down with respiratory movements. Its lower border extended to within 3 inches of the anterior superior spine. Its inner border was about 3 inches from the mid-abdominal line. It was rather globular in shape and appeared to be about the size of a large adult head. It could not be grasped between the hands as easily as one can generally grasp a renal tumor. Neither did it bulge out as far laterally. The left kidney could not be recognized. The colon was internal to the cyst. The diagnosis was uncertain. It rested between a pancreatic, renal or suprarenal cyst.

Operation, May 24, 1906.—An oblique incision was made parallel in its upper part to the last rib and at its lower part curving forward towards the umbilicus. When the tumor was exposed, it was found to be cystic, the color of its wall rather dullish gray. It was universally adherent, the colon being in front and inward. With a trocar and cannula 9 pints of yellowish-green, dirty-looking fluid were removed. It was thin in consistency, but floating in it were numerous small flakes, yellowish-brown in color, and also cholesterine crystals. The kidney was now recognized, pushed down into the patient's pelvis and adherent to the lower pole of the cyst. The latter was separated from it without injury to the kidney. The removal of the cyst was very tedious, on account of the numerous blood vessels which required ligation. The dissection was especially difficult where its wall extended to the median line, at which point it was attached to the vertebral bodies and wall of the aorta. The sac was completely removed; no pedicle was recognized. Three long artery forceps were left *in situ,* as they clamped vessels near to the median line where ligation would have been most difficult. The wound was sutured, a gap being left through which a strip of gauze and a rubber tube were inserted for drainage. The duration of the operation was about 60 minutes. There was but little shock and the patient left the table in excellent condition. The convalescence was uneventful. The patient was out of bed on the eighteenth day, and returned home on the twenty-fourth day.

Since the operation the patient has been free from pain, and as far as the loss of the suprarenal is concerned, enjoys good health. The slight bronzing of the skin disappeared soon after the operation.

Pathological Report by JOHN M. THACHER.—Macroscopical examination: Ruptured cyst. Wall averages ⅛ inch to ⅙ inch thick, showing granular red and yellow surface interiorly, and numerous small (¾ inch) roundish nodules of fibrin. Yellow flakes and dots in various layers of wall resemble calcified (?) patches; and larger ones cut with gritty or chalky feel. There is no discoverable pedicle, the outer surface having been apparently adherent everywhere.

Microscopical examination: The cyst wall shows internally fibrin, blood cells, no lining cells. Next comes a generally distributed calcified area lying in coarse strands of c. t. Exterior to this are oval and elongated masses of cells which appear to constitute a cellular neoplasm of the mesoblastic type. The cells are rounded and plump, outlines indistinct, nuclei clear and a little larger than red cells, cytoplasm sometimes coarsely granulated or globulated. The cells are in small groups supported by very fine c. t. strands. The general structure is that of endothelioma, or of the tumors commonly called aberrant adrenals.

Symptoms.—The symptoms of adrenal cysts are at first apt to be rather indefinite, and even after the development and recognition of a distinct tumor exact diagnosis is generally very difficult. The first symptom noticed by the patient is often a vague indefinite ache in the hypogastric region. Instead of an ache, the sensation may be described as a stabbing neuralgic pain, suggesting neuralgia of the lower intercostal nerves, or pleurodynia. The patient is apt to describe the pain as originating from the depths of the hypogastric region, well up under the vault of the diaphragm, from which area it radiates outward in the direction of the loin or perhaps around the abdomen.

Instead of a gradual development of symptoms, however, the onset may be severe and sudden, somewhat resembling that of acute pancreatitis. The cause of this stormy onset is probably a hæmorrhage in the suprarenal body, with resulting hæmatoma, which affords a starting point for the development of a cyst. The nausea, vomiting, severe pain and perhaps collapse, which accompanies such an onset, may be again

repeated during the farther development of the cyst, and the cause is probably another hæmorrhage within the cyst wall.

Other symptoms, as a rule, do not develop until the tumor has attained considerable size. A feeling of pressure and a sense of enlargement of the upper abdomen may be the first symptom which demands painstaking examination and reveals the presence of a tumor. The growth of the tumor in some cases has been quite rapid, in others very slow. Generally, however, more or less indefinite symptoms have persisted for many months before the presence of a tumor has been appreciated. As the tumor increases in size, the pressure symptoms become more pronounced. The pain is apt to increase after the meals, when the stomach is distended. Vomiting will often afford relief. In certain cases the pain may come in paroxysms with vomiting. There is often a sense of constriction of the lower chest and some difficulty in breathing. These thoracic manifestations are probably due to the tugging of the tumor on the fascia præ- and retro-renalis (Testut) which connects the suprarenal body with the diaphragm.

The patient may be the first to call attention to the bulging which he notices under the free border of the ribs, or the surgeon may, in examination for the deep-seated pain, be the first to discover the mass, which gradually enlarges downwards and forwards. Generally, however, the outline of the cyst cannot be definitely defined until it has attained considerable size. It then feels like a more or less globular, smooth, elastic and rather tense tumor. The wave of fluctuation is apt to be indistinct. The sensation from palpation resembles that of a fairly thick walled unilocular ovarian cyst. The projection of the tumor is apt to be upwards towards the vault of the diaphragm, rather than outwards toward the loin. It gives an impression of immobility. This is due to the firm attachment of the suprarenal bodies to the back. At first it is apt to move with respiration. Its projection upwards against the diaphragm may displace the heart and compress the lung, causing circulatory and respiratory disturbances. The kidney is usually dislocated downwards, the panereas downwards and

forwards, the liver upwards and forwards and toward the median line. The colon of course rests in front of the tumor. It is generally pushed over towards the median line.

As already stated, the exact recognition of an adrenal cyst is very difficult. Its differentiation from renal, pararenal, pancreatic and splenic cysts is often impossible. Adrenal cysts are apt to feel more firmly fastened to the back than are pancreatic cysts, which often are to a certain extent movable. Renal cysts are inclined to grow more towards the lateral wall of the loin; they can also be more easily palpated by bimanual examination, and appear less fixed. Their shape is also apt to be more or less oval rather than globular. The urinary examination is of but little value, as in either case abnormal constituents may be either absent or present. The kidney is often dislocated downwards by these cysts, and it sometimes can be recognized well down towards the pelvis. Unfortunately, however, for differential diagnosis, it is generally adherent to the cyst, which fact renders this sign of but little value. Splenic cysts are apt to appear laterally under the free border of the ribs, rather than in the deep hypogastric region. They also at times give the perisplenetic friction sound. Neither the pararenal cysts, nor those rare cysts which spring from the the remnants of the bodies of Müller or Wölff can be clinically distinguished from adrenal cysts. Blood examinations are of value in differentiating these cysts from echinococcus cysts where there is generally a distinct increase in the eosinophile cells. Bronzing of the skin has not been noted as a symptom.

Treatment.—Operation is of course the appropriate remedy. Complete extirpation is always advisable; but the dangers attending this procedure may be so great that marsupialization may be preferable. For purely diagnostic purposes an aspirating syringe may be employed, but a certain risk attends the aspiration of any abdominal cyst, and it is much wiser to defer any such procedure until the tumor has been exposed by means of an incision. The removal of an adrenal cyst may be accomplished through either an abdominal or a lumbar incision. My own preference is decidedly for a lumbar

incision. The approach through an opening made in the loin is more direct, it avoids the handling of the intraperitoneal organs, which must necessarily take place if the tumor be reached through an abdominal incision, and it offers the most direct route for drainage. The direction of the incision must naturally vary somewhat according to the case, but in a general way, an oblique direction from behind downwards and forwards below the last rib, is the most convenient, such an incision is usual for extirpation of the kidney and ureter. For additional space it may be necessary to remove the last rib.

If the abdominal incision be preferred, the cyst may be approached: *a*, through the lesser omentum (Hadra); *b*, through the ligamentum gastrocolocum (Kronlein, Routier); *c*, through the pancreas recess of Waldeyer.

The main dangers of the operation are hæmorrhage from the pancreas or the larger veins, and injury to the descending colon or to the sympathetic plexus. These cysts are usually very adherent and considerable time is consumed, and blood lost in enucleation of the sac. The adhesions toward the vertebral column and abdominal aorta, are especially troublesome, and in some of the cases subjected to operation have prevented complete removal of the cyst. Severe collapse has followed many of the operations. This may be due to blood lost, time of exposure, shock due to peeling the tumor from the diaphragm or sympathetic nerves, or possibly to poisoning by the adrenal secretion.

The relation of the kidney to these cysts is of interest. In 3 cases it was found at operation so firmly adherent that its removal with the cyst was necessary. In 3 other cases it was quite free and was not disturbed. In all cases except perhaps one it was dislocated downwards.

The loss of one suprarenal gland is quite compatible with life and good health. In animals the loss of both glands means death.

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